

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE

Application No.	:	10/698,564	Confirmation No. 1121
Applicant	:	Tapesh Yadav	
Filed	:	October 31, 2003	
Title:	:	HIGH VOLUME MANUFACTURING OF NANOPARTICLES AND NANO-DISPERSED PARTICLES AT LOW COST	
TC/A.U.	:	1792	
Examiner	:	Elena Tsoy Lightfoot	
Docket No.	:	037768-0173	
Customer No.	:	24959	

**APPEAL BRIEF**

Mail Stop Appeal Brief – Patents  
Commissioner for Patents  
P. O. Box 1450  
Alexandria, VA 22313-1450

September 1, 2009

This Appeal Brief is timely filed in response to the Final Office Action mailed April 1, 2009. This Appeal Brief relates to the appeal of the rejection of claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35.

The headings used hereinafter and the subject matter set-forth under each heading is in accordance with 37 C.F.R. § 41.37(c). Appellant hereby appeals the rejection of the captioned case set forth in the Final Office Action dated April 1, 2009.

**I. REAL PARTY IN INTEREST**

Tapesh Yadav is the inventor of the invention described and claimed in the above-identified application. The inventor assigned all right, title, and interest in the invention of the application to NanoEnergy Corporation as evidenced by assignment which was filed with the United States Patent and Trademark Office (USPTO) and recorded on June 14, 2007 at Reel 019429 Frame 0583. A Change of Name document identifying a change of name from NanoEnergy Corporation to NanoProducts Corporation was filed with the USPTO and recorded on September 18, 2005 at Reel 016547 Frame 0085. NanoProducts Corporation subsequently assigned all right, title, and interest in the invention to PPG Industries Ohio, Inc. as evidenced by assignment which was filed with the USPTO and recorded on February 22, 2008 at Reel 020540 Frame 0506.

## **II. RELATED APPEALS AND INTERFERENCES**

There are no related appeals, judicial proceedings or interferences known to the Appellant which directly affect or will be directly affected by or have a bearing on the Board of Patent Appeals and Interferences' decision in the pending appeal.

### **III. STATUS OF CLAIMS**

Claims 1, 2, 4-15, 17, 18, 20-23 and 25-35 are pending in the application.

Claims 1, 4, 6, 11-15, 17, 18, 20, 27, and 31-35 have been rejected.

Claims 2, 5, 7-10, 21-23, 25, 26 and 28-30 have been withdrawn.

Claims 3, 16, 19 and 24 were previously canceled.

The claims on Appeal are claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35.

#### **IV. STATUS OF AMENDMENTS**

No amendments have been filed subsequent to the rejection of claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35 in the Final Office Action mailed April 1, 2009.

## **V. SUMMARY OF CLAIMED SUBJECT MATTER**

The rejected claims are generally directed to a method of manufacturing nanopowders. The method includes preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor. The slurry precursor is fed to a reaction zone of a high temperature reactor thereby creating a vapor of the slurry precursor. A reactive fluid is added to the slurry precursor in the reaction zone thereby creating a stream of vaporized slurry precursor and reactive fluid. The stream is processed at a high temperature and is then cooled to nucleate the slurry precursors thereby creating nucleated nanoscale powders. The stream of nucleated nanoscale powders are quenched thereby preventing agglomeration and grain growth. The manufactured powder of the claimed method is nano-dispersed nanopowders of carrier particles and metal-containing precursor particles that are dispersed on and attached to the surface of the carrier particle.

Independent claim 1 is directed to the method described above. Support for independent claim 1 can be found throughout the specification, drawings and claims as originally filed. Specifically, support for the step of preparing a mixture (Ref. Nos. 100, 102 and 104 in Fig. 3) can be found on pages 21-22, paragraph 52, lines 1-9. Support for feeding the slurry precursor to a reaction zone can be found on page 22, paragraph 53, lines 1-4. Support for adding a reactive fluid (Ref. No. 108 of Fig. 3) can be found on page 22, paragraph 53, lines 4-6. Support for processing the stream at high temperature (Ref. No. 106 of Fig. 3) can be found at page 25, paragraph 61, lines 1-4. Support for cooling the stream to nucleate the slurry precursor (Ref. No. 110 of Fig. 3) can be found on page 28, paragraph 68, lines 3-5. Support for quenching the stream of nucleated nanoscale powders (Ref. No. 116 in Fig. 3) can be found on page 29, paragraph 69, lines 1-4. Support the for the production of nanodispersed nanopowders (Ref. No. 120 of Fig. 3) of carrier particles and metal-containing precursor particles that are dispersed on and attached to the surface on the carrier particles can be found on page 4, paragraph 9, lines 6-9.

**VI. GROUNDS OF REJECTION TO BE REVIEWED ON APPEAL**

I. Whether claim 15 is enabling for “a temperature greater than 1500°C” under 35 U.S.C. § 112, first paragraph.

II. Whether claims 1, 4, 6, 11-20, 27 and 31-35 are enabling under 35 U.S.C. § 112, first paragraph.

III. Whether claims 1, 4, 6, 11-20, 27, 31-35 are definite under 35 U.S.C. § 112, second paragraph for the use of the term “high”.

IV. Whether claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,489,449 to Umeya et al. in view of U.S. Patent No. 5,984,997 to Bickmore et al.

V. Whether claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,984,997 to Bickmore et al. in view of U.S. Patent No. 5,489,449 to Umeya et al.

VI. Whether claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,356,120 to Konig et al. in view of U.S. Patent No. 3,565,676 to Holzl, further in view of U.S. Patent No. 5,489,449 to Umeya et al.

VII. Whether claims 31-33 are patentable under 35 U.S.C. § 103(a) over U.S. Patent No. 5,356,120 to Konig et al. in view of U.S. Patent No. 3,565,676 to Holzl, further in view of U.S. Patent No. 5,489,449 to Umeya et al. and further in view of U.S. Patent No. 5,984,997 to Bickmore et al.

## **VII. ARGUMENTS**

The arguments set forth in the Amendment and Reply dated June 11, 2007 in response to the Non-Final Office Action mailed March 9, 2007; the arguments set forth in the Amendment and Remarks dated April 17, 2008 in response to the Final Office Action mailed July 17, 2007; arguments set forth in the Amendment After Finals dated August 5, 2008, September 9, 2008 and October 9, 2008 in response to the Final Office Action mailed June 9, 2008; the arguments set forth in the Amendment dated February 17, 2009 in response to the Non-Final Office Action mailed November 18, 2008; and the arguments set forth in the Pre-Appeal Brief Request for Review dated July 1, 2009 in response to the Final Office Action mailed April 1, 2009 are hereby incorporated by reference in their entireties. Each ground of rejection presented for review is addressed hereinafter under the appropriate heading.



I. THE RECITATION OF “A TEMPERATURE GREATER THAN 1500°C” IN CLAIM 15 IS ENABLED BY THE SPECIFICATION

The Office has set forth a rejection of claim 15 under 35 U.S.C. § 112, first paragraph for failing to comply with the enablement of scope requirement. The Office alleges that the “specification, while being enabling for 1500-4000°C, does not reasonably provide enablement for unlimited temperature of greater than 1500°C, e.g. 1,000,000°C or more.” The Office further contends that the Appellant’s “specification does not show [that] the upper most limit for heating is obviously bound by what can be realistically achieved, and thus the scope of the claimed invention is uncertain” [page 7, Final Office Action dated April 1, 2009].

The enablement requirement of 35 U.S.C. § 112, first paragraph, requires the specification to enable those skilled in the art to make and use the full scope of the claimed invention without undue experimentation. Accordingly, the test of enablement is whether one reasonably skilled in the art could make and use the invention from the disclosures in the specification coupled with information known in the art without undue experimentation. Factors that assist in determining if experimentation is “undue” include for example: the breadth of the claims, the nature of the invention, the state of the prior art, the level of one of ordinary skill, the level of predictability in the art, as well as the amount of direction provided by the inventor. *In re Wands*, 858 F.2d 731, 737, 8 USPQ 2d 1400, 1404 (Fed. Cir. 1988). Further, the specification does not necessarily have to describe how to make and use every possible variant of the claimed invention, for the artisan’s knowledge of the prior art and routine experimentation can often fill gaps; interpolate between embodiments and perhaps even extrapolate beyond the disclosed embodiments, depending upon the predictability of the art. *AK Steel Corp. v. Sollac*, 344 F.3d 1234, 68 USPQ 2d 1280, 1287 (Fed. Cir. 2003). In order for an enablement rejection under 35 U.S.C. § 112, first paragraph to be made, the Examiner has the initial burden of establishing a reasonable basis to question the enablement provided for the claimed invention. *In re Wright*, 999 F.2d 1557, 1562, 27 USPQ 2d 1510, 1513 (Fed. Cir. 1993).

Appellant contends that the specification as originally filed clearly enables the processing temperature of “greater than 1500°C” recited in claim 15. Specifically, paragraph 62 of the specification as filed states:

***The high temperature processing is conducted at step 106(Figure 3) at temperatures greater than 1500°C, preferably 2500°C, more preferably than 3000°C, and more preferably greater than 4000°C.***

The specification explicitly provides enablement for temperatures greater than 1500°C thereby rendering the Office’s rejection moot. Furthermore it appears that the Office has arbitrarily concluded that the specification is only enabling for temperatures between “1500-4000°C”, when clearly the specification discloses otherwise.

Moreover, there is no requirement that an upper limit for the temperature be defined to be enabling. The upper most limit for heating is obviously bound by what can realistically be achieved as appreciated by one skilled in the art. Clearly one skilled in the art, based on the disclosure in paragraph 62 would appreciate that an upper temperature of 1,000,000°C is not “realistic”. Furthermore, the Appellant’s specification provides explicit guidance on processing temperatures, such as greater than 2500°C, greater than 3000°C and greater than 4000°C. Accordingly, the Office’s assertion that the Appellant’s claims would encompass a temperature of 1,000,000°C would be an unreasonable interpretation of the claims to one of ordinary skill in the art.

Clearly, between the specification, the claims and the knowledge of one of ordinary skill in the art, one of ordinary skill in the art would be able to practice the claimed invention at a temperature greater than 1500°C without undue experimentation. Thus, a temperature “greater than 1500°C” is enabled by the specification as originally filed, and claim 15 is in compliance with the enablement requirement as set forth in 35 U.S.C. § 112, first paragraph. For at least these reasons, Appellant respectfully requests that the Office’s rejection of claim 15 under 35 U.S.C. § 112, first paragraph be overturned.

## II. CLAIMS 1, 4, 6, 11-20, 27 AND 31-35 ARE ENABLED BY THE SPECIFICATION

The Office rejected claims 1, 4, 6, 11-20, 27, and 31-35 stating that “the high temperature processing conducted at temperatures greater than 1500°C, preferably 2500°C,

more preferably greater than 3000°C, and most preferably greater than 4000°C [is] critical or essential to the practice of the invention, but not included in the claim(s) is not enabled by the disclosure” (pages 2-3 of the Final Office Action dated April 1, 2009). Appellant submits as stated above, that the specification, specifically paragraph 62, provides explicit support for processing temperatures of “greater than 1500°C” and higher temperatures. Furthermore, the Office’s assertion regarding ‘criticality’ of the temperature is not supported. Appellant’s specification does not state criticality of a particular temperature and therefore the Office’s position with respect to criticality is unwarranted. To the contrary, paragraph 58 of the specification as shown below, describes a varying range of temperatures.

*While the above examples specifically teach methods of preparing dispersed powders of oxides, carbides, nitrides, borides, and carbonitrides, the teachings may be readily extended in an analogous manner to other compositions such as chalcogenides. While it is preferred to use high temperature processing, a moderate temperature processing or a low/cryogenic temperature processing may also be employed to produce high purity nano-dispersed powders.*

Appellant submits that the Office’s position with respect to criticality is unfounded. Furthermore, for at least the reasons set forth above, the temperatures recited in the claims are enabled by the specification as originally filed, and claims 1, 4, 6, 11-20, 27, and 31-35 are in compliance with the enablement requirement as set forth in 35 U.S.C. § 112, first paragraph. For at least these reasons Appellant respectfully requests that the Office’s rejection of claims 1, 4, 6, 11-20, 27 and 31-35 under 35 U.S.C. § 112, first paragraph be overturned.

III. CLAIMS 1, 4, 6, 11-20, 27 AND 31-35 INCLUDE THE RECITATION OF “CARRIER PARTICLES” AND ARE ENABLED BY THE SPECIFICATION AND THIS REJECTION IS RENDERED MOOT IN VIEW OF THE AMENDMENT FILED FEBRUARY 17, 2009

Appellant points out that Paragraphs 6 and 7 on page 3 of the Office Action dated April 1, 2009 are related as they address the same rejection. Paragraph 7 recites a rejection that was set forth in the Office Action dated November 18, 2008. Appellant amended

the claims to include “carrier particles” in the Amendment filed February 17, 2009 to address the rejection. In view of such amendment, paragraph 6 in the Final Office Action dated April 1, 2009 indicates that the rejection is withdrawn, however it appears that paragraph 7 should have been deleted but was inadvertently included. Nevertheless, while Appellant believes this rejection to be moot, Appellant submits that claims 1, 4, 6, 11-20, 27 and 31-35 include “carrier particles” and claims 1, 4, 6, 11-20, 27, 31-35 are in compliance with the enablement requirement as set forth in 35 U.S.C. § 112, first paragraph.

IV. THE TERM “HIGH” WAS REJECTED AS BEING INDEFINITE IN CLAIMS 1, 4, 6, 11-20, 27 AND 31-35

The Office rejected claims 1, 4, 6, 11-20, 27, and 31-35 under 35 U.S.C. § 112, second paragraph, for indefiniteness. As submitted in the Pre-Appeal Brief Request for Review dated July 1, 2009, Appellant is willing to amend “high” as recited the pending claims to attend to the rejection.

V. CLAIMS 1, 4, 6, 11-15, 17, 18, 20, 27, AND 31-35 ARE NOT OBVIOUS UNDER 35 U.S.C. § 103(A) OVER U.S. PATENT NO. 5,489,449 IN VIEW OF U.S. PATENT NO. 5,984,997

The Office has rejected claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,489,449 to Umeya et al. (hereinafter “Umeya”) in view of U.S. Patent No. 5,984,997 to Bickmore et al. (hereinafter “Bickmore”).

The Office concedes that Umeya fails to teach the step of “preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor” and then “feeding the slurry precursor to a reaction zone of a high temperature reactor thereby creating a vapor of the slurry precursor” as recited in independent claim 1 [Final Office Action dated April 1, 2009]. The Office also concedes that Umeya fails to teach that ultrafines of the inorganic non-metallic or metallic materials are prepared by processing metal carboxylates in the presence off air and the combustion product gases are cooled and *quenched (emphasis added)* to freeze the growth and further reaction of the product [Office Action dated November

18, 2008]. Additionally in the Office Action dated November 18, 2008, the Office concedes that Bickmore et al. fails “to teach that carrier particles are added to a stage of combustion processing (claims 16)”, which was the subject matter incorporated into independent claim 1 in the Amendment filed February 17, 2009. However, the Office appears to contend in the Final Office Action dated April 1, 2009 that the process steps of Umeya comprising mixing three ingredients: (1) ultrafines, (2) core particles and (3) a stream of fluidizing gas in an order: (1) + (3), then adding (2), i.e. mixing the ultrafines with a gas stream, then mixing core particles with the resulting mixture, would be obvious over another order of adding components: (1) + (2), then adding (3), namely mixing ultrafines with the core particles and then adding the mixture into the stream, in the absence of showing criticality, further stating that a selection of any order of performing process steps or any order of mixing ingredients is *prima facie* obvious.

#### 1. Relevant Law

To determine obviousness, a four part test, as set-forth in *Graham v. John Deere Co.*, is employed to examine the: (i) content and scope of the prior art; (ii) level of ordinary skill in the art; (iii) differences between the prior art and the claimed invention; and (iv) objective evidence of nonobviousness.<sup>1</sup> To establish a *prima facie* case of obviousness, there must be some teaching, suggestion or motivation to combine the references, there must be some reasonable expectation of success based upon the teachings of the references, and the prior art references, when combined, must teach or suggest all of the claim limitations.<sup>2</sup> Moreover, it is often necessary to take these factors into consideration in order to determine whether there was an apparent reason to combine known elements in the fashion claimed by the patent at issue and consider whether the combined elements yield predictable results.<sup>3</sup>

In order to rely on a reference as a basis for rejection under 35 U.S.C. § 103(a), the reference must be analogous prior art by either being in the field of the inventor’s endeavor or be reasonably pertinent to the particular problem with which the inventor was concerned.<sup>4</sup>

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<sup>1</sup> *Graham v. John Deere Co.*, 383 U.S. 1, 17-18 (1966); *Iron Grip Barbell Co., Inc. v. USA Sports, Inc.*, 392 F.3d 1317, 1320 (Fed. Cir. 2004).

<sup>2</sup> MPEP 2143.

<sup>3</sup> *KSR Int’l Co. v. Teleflex Inc.*, 127 S. Ct. 1727, 1740-41 (S. Ct. 2007).

<sup>4</sup> *Oetiker*, 977 F.2d at 1447; *In re Clay*, 966 F.2d 656, 659 (Fed. Cir. 1992).

Generally, a reference may be considered reasonably pertinent if, even though it is in a different field, it is one in which logically, it would have commended itself to an inventor's attention in considering the problem.<sup>5</sup>

To establish a *prima facie* case for obviousness, the elements of the cited references must be combined in such a way so as to yield predictable results.<sup>6</sup> "The mere fact that references can be combined or modified does not render the resultant combination obvious unless the results would have been predictable to one of ordinary skill in the art."<sup>7</sup> The Supreme Court has reaffirmed that there must be some rationale for combining references and predictability is a necessary component for perfecting a *prima facie* case for obviousness: "A rationale to support a conclusion that a claim would have been obvious is that all the claimed elements were known in the prior art and one skilled in the art could have combined the elements as claimed by known methods with no change in their respective functions, and the combination would have yielded nothing more than predictable results to one of ordinary skill in the art."<sup>8</sup>

## 2. ARGUMENTS

First and foremost, Appellant contends that the Office has not given the claims as a whole, due consideration with respect to their scope as process steps. The Office states in the Final Office Action dated April 1, 2009, that the process steps of Umeya "comprising mixing three ingredients would be obvious over another order of adding components..." It appears that the Office's position is that the present claimed invention merely encompasses rearranging the order of processing steps or mixing ingredients. Appellant disagrees with the Office's position, as there cannot be a *prima facie* case of obviousness with respect to an order

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<sup>5</sup> *Clay*, 966 F.2d at 659 (Fed. Cir. 1992). In *In re Clay*, the Court held that the reference at issue could not be considered to be within the inventor's field of endeavor "merely because both relate to the petroleum industry." *Id.* The prior art reference taught the use of a gel in irregular volumes within underground, natural oil bearing formations to direct flow under extreme conditions, whereas the invention at issue taught introduction of gel to a confined volume in a man-made storage tank at ambient temperature and atmospheric pressure. *Id.* Based upon the teachings, the Court found that the field of endeavor of the prior art reference was "*extraction* of crude petroleum" whereas the inventor's field of endeavor was the "*storage* of refined liquid hydrocarbons." *Id.*

<sup>6</sup> MPEP 2143.

<sup>7</sup> MPEP 2143.01 III, emphasis original.

<sup>8</sup> *KSR International Co. v. Teleflex Inc.*, 550 U.S. \_\_\_, \_\_\_, 82 USPQ2d 1385, 1396 (2007), as cited in MPEP 2143.02.

of steps, if the cited references, namely Umeya and Bickmore *do not disclose or suggest the claimed steps*. Appellant contends as previously stated during prosecution of the application, that neither Umeya nor Bickmore disclose or suggest a method of manufacturing powder as recited in the pending claims.

Appellant is claiming a method that requires preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry, feeding the slurry to a high temperature reactor to create a vapor of the slurry precursor, adding a reactive fluid thereby creating a stream of vaporized slurry precursor and reactive fluid, processing the stream, cooling the stream to nucleate the slurry precursor and quenching the stream of nucleated nanoscale powders to form a nano-dispersed nanopowder of carrier particles and metal-containing precursor particles that are dispersed on and attached to the surface of the carrier particles.

Umeya as conceded by the Office teaches a method of “contacting said ultrafines of the coating material with particles of the core material in a fluidized state to strongly deposit the ultrafines onto the surface of said core material” (Office Action dated November 18, 2009, page 6). In fact, column 2, lines 23-25 of Umeya, as identified by the Office, teaches that particles of the core material in a monodispersed state are introduced into a stream carrying the ultrafines of the coating material. As such, a mixture or slurry precursor of one or more metal-containing precursors (i.e., ultrafines) and carrier particles (i.e., core material) in Umeya is never prepared. Hence, Umeya fails to teach or suggest the step of preparing a mixture as recited in independent claim 1, and moreover, Umeya necessarily fails to teach or suggest the step of feeding a mixture of one or more metal-containing precursors and carrier particles (i.e., Appellant’s claimed “slurry mixture”) into a reactor.

Furthermore, the Office itself has conceded that Umeya does not teach the step of preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor and then feeding the slurry precursor to a reaction zone of a high temperature reactor thereby creating a vapor of the slurry precursor or cooling and quenching to freeze the growth and further reaction of the product [Office Actions dated April 1, 2009 and November 18, 2008]. Additionally for the record, Appellant contends that Umeya further fails

to teach or suggest the steps of feeding the slurry precursor to a reaction zone, adding a reactive fluid to the slurry precursor to create a stream of vaporized slurry precursor and reactive, processing the stream, cooling the stream to nucleate the slurry precursor thereby creating nucleated nanoscale nanopowders, and quenching the stream of nucleated nanoscale powders thereby preventing agglomeration and grain growth. As Umeya uses core materials in a stream of ultrafines, Umeya does not, and furthermore would not teach steps of cooling for nucleation of nanopowders or quenching the stream to prevent agglomeration and grain growth.

Bickmore clearly fails to cure the deficiencies of Umeya. Bickmore describes a method for producing homogenous nanoparticle powders from mixtures of elements and not from one or more metal-containing precursors and carrier particles such that nano-dispersed powders of carrier particles and metal-containing precursors dispersed thereon are produced as presently claimed. As such, Bickmore can be relied upon at most for providing a method for producing carrier particles and nothing more. Further evidencing Bickmore's lack of teaching carrier particles and therefore, the inability of Bickmore to teach a mixture of metal-containing particles and carrier particles to form a slurry, is the Office conceding in the Office Action dated November 18, 2008, that Bickmore fails to teach that carrier particles are added to a stage of combustion processing (claims 16), which was the subject matter incorporated into independent claim 1 in the Amendment filed February 17, 2009. Therefore, Bickmore fails to teach or suggest preparing a mixture of metal-containing precursors and carrier particles to create a slurry precursor and therefore fails to cure the deficiencies of Umeya.

Accordingly, neither Umeya nor Bickmore alone or in combination disclose the step of preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor. Further, as the Office has conceded that at least neither Umeya nor Bickmore teach the step of preparing a mixture of metal-containing precursors and carrier particles to create a slurry precursor, Appellant contends that the present obviousness rejections are moot.

Notwithstanding the above, it appears that the basis of the Office's position with respect to the rejections presented during the course of the prosecution of this application has focused on the content or composition of the materials used in the method rather than the method itself as the Office has attempted to combine references based on the composition of



particles taught rather than the steps disclosed for producing materials. Further evidencing the Office's focus on the content or composition of the materials rather than the actual claimed steps of the method is the Office's statement in regards to rearranging the order of steps/mixing ingredients. While Appellant can appreciate the Office's position with respect to obviousness when merely rearranging the order of steps or mixing of ingredients, such position would be warranted if for example, considering a product or product-by-process claim, and not for a method claim. Rearranging the order of steps in a method claim would render the claimed method inoperative.

Nevertheless, neither Umeya or Bickmore alone or in combination in any order teach or suggest a method of manufacturing a nano-dispersed nanopowder of carrier particles and metal-containing precursor particles that are dispersed on and attached to the surface of the carrier particles as claimed. Accordingly, Appellant respectfully requests that the Office's rejection under 35 U.S.C. § 103(a) of claims 1, 4, 6, 11-15, 17, 18, 20, 27, and 31-35 be overturned.

VI. CLAIMS 1, 4, 6, 11-15, 17, 18, 20, 27, AND 31-35 ARE NOT OBVIOUS UNDER 35 U.S.C. § 103(A) OVER BICKMORE IN VIEW OF UMEYA

The Office has rejected claims 1, 4, 6, 11-15, 17, 18, 20, 27 and 31-35 under 35 U.S.C. § 103(a) as being unpatentable over Bickmore in view of Umeya.

In the Office Action dated November 18, 2008, the Office while citing Bickmore for allegedly teaching the claimed invention, concedes that Bickmore fails "to teach that carrier particles are added to a stage of combustion processing (claims 16)", which was the subject matter (i.e. carrier particles) incorporated into independent claim 1 in the Amendment filed February 17, 2009. The Office further concedes that Umeya fails to teach the step of "preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor" and then "feeding the slurry precursor to a reaction zone of a high temperature reactor thereby creating a vapor of the slurry precursor" as recited in independent claim 1 [Final Office Action dated April 1, 2009]. The Office also concedes that Umeya fails to teach that ultrafines of the inorganic non-metallic or metallic materials are prepared by processing metal carboxylates in the presence of air and the combustion product gases are

cooled and *quenched* (*emphasis added*) to freeze the growth and further reaction of the product [Office Action dated November 18, 2008]. The Office however [note the Office Action dated April 1, 2009 relies on its position set forth in the Office Action dated November 18, 2008] states that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a process of Bickmore for producing ceramic particles coated with a metallic material such as a metal alloy by adding to a ceramic powder formed in the reaction zone of the flow reactor core ceramic particles.

Bickmore describes a method for producing homogenous nanoparticle powders from mixtures of elements and not from one or more metal-containing precursors and carrier particles such that nano-dispersed powders of carrier particles and metal-containing precursors dispersed thereon are produced as presently claimed. As such, Bickmore can be relied upon for providing a method for producing carrier particles and nothing more. Additionally, the Office concedes that Bickmore does not disclose or suggest preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor as “Bickmore fails to teach that carrier particles are added to a stage of combustion processing (claim 16)”. Accordingly Bickmore fails to teach the use of carrier particles in the claimed process, i.e. preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor, and accordingly any of the subsequent steps using a slurry having carrier particles, and producing a nano-dispersed nanopowder of carrier particles and metal-containing precursor particles that are dispersed on and attached to the surface of the carrier particles.

Umeya fails to cure the deficiencies for at least the reasons discussed in the preceding rejection, namely for failing to teach a slurry precursor of metal-containing precursors and carrier particles. Further as conceded by the Office, neither Umeya nor Bickmore teach the step of preparing a mixture of metal-containing precursors and carrier particles to create a slurry precursor, and therefore Appellant contends that the present obviousness rejections are moot. For at least the reasons above, Appellant respectfully requests that the Office’s rejection under 35 U.S.C. § 103(a) of claims 1, 4, 6, 11-15, 17, 18, 20, 27, and 31-35 be overturned.

VII. CLAIMS 1, 4, 6, 11-15, 17, 18, 20, 27, AND 31-35 ARE NOT OBVIOUS UNDER 35 U.S.C. § 103(A) OVER U.S. PATENT NO 5,356,120 TO KONIG, ET AL. IN VIEW OF U.S. PATENT NO. 3,565,676 TO HOLZL ET AL. IN VIEW OF UMEYA

The Office has rejected claims 1, 4, 6, 11-15, 17, 18, 20, 27, and 31-35 under 35 U.S.C. § 103(a) as being unpatentable over U.S. Patent No. 5,356,120 to Konig et al. (hereinafter “Konig”) in view of U.S. Patent No. 3,565,676 to Holzl et al. (hereinafter “Holzl”) in view of Umeya.

The Office concedes that Konig in view of Holzl fails to teach that carrier particles are added to the stage of the combustion processing (claim 16); the powder manufactured comprises carrier particles comprising ceramic and attached particles comprising an alloy (claim 27) [page 14 of Office Action dated November 18, 2008]. The Office states that it would have been obvious to one of ordinary skill in the art at the time the invention was made to have used a process of Konig in view of Holzl for producing ceramic particles coated with a metallic alloy. However, the Office appears to assert that Konig fails to teaches every element of independent claim 1 except the step of processing the stream at high temperatures, since on page 12 of the Office Action dated November 18, 2009, the Office asserted that Konig teaches every element of independent claim 1 except “that the combustion processing was conducted at temperatures “[sic] greater than 2500° C (claim 1) or 3000° C (claim 15).” The Office asserts that Holzl teaches that “the temperature of thermal processing of the metal precursor in a reaction zone would depend on a particular metal precursor” (Office Action dated November 18, 2009, page 13) based on Holzl’s description of preparing a porous tungsten coating from tungsten tetrafluoride (WF<sub>4</sub>). Additionally, the Office relies on Umeya to “remedy Konig in not showing the addition of carrier particles” [page 7, Office Action dated April 1, 2009].

Appellant submits that independent claim 1 does not recite either “combustion processing” or “processing at “greater than 2500° C” as asserted by the Office and that the Office is reading limitations into independent claim 1 that are not there. The Office is reminded that it is impermissible to import subject matter from the specification into the claim (see MPEP 2111). For at least this reason, the Office’s rejection of independent claim 1 over

Konig in view of Holzl further in view of Umeya has been made improperly and should be withdrawn.

Additionally, notwithstanding the foregoing, Konig, Holzl and Umeya each fail to teach or fairly suggest “preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor” and then “feeding the slurry precursor to a reaction zone of a high temperature reactor thereby creating a vapor of the slurry precursor” as recited in independent claim 1. Konig is directed to a gas phase reactor for producing finely-divided metal and/or ceramic powder. Holzl is directed to a chemical vapor deposition method for coating a substrate. The Office relies on Holzl for its teaching of a thermal processing temperature. However Holzl does not teach or suggest the claimed method including the step of preparing a mixture of metal containing particles and carrier particles to create slurry, and therefore fails to cure the deficiencies of Konig. Further, the Office relies on Umeya’s teachings of the carrier particle to cure the deficiencies of Konig, however Umeya fails to teach or suggest the claimed method including the step of preparing a mixture of metal-containing particles and carrier particles to create a slurry as conceded by the Office and therefore, fails to cure the deficiencies of Konig and Holzl. Furthermore it is unclear why one skilled in the art would even combine the teachings of all of the references cited by the Office. Accordingly, the combination of references cited by the Office fail to teach or suggest all the elements of independent claims and therefore, fails to render the claim’s obviousness. Accordingly, Appellant respectfully requests that the Office’s rejection under 35 U.S.C. § 103(a) of claims 1, 4, 6, 11-15, 17, 18, 20, 27, and 31-35 be overturned.

VIII. CLAIMS 31-33 ARE NOT OBVIOUS UNDER 35 U.S.C. § 103(A) OVER KONIG IN VIEW OF HOLZL, AND FURTHER IN VIEW OF UMEYA, AND FURTHER IN VIEW OF BICKMORE.

The Office has rejected dependent claims 31-33 under 35 U.S.C. § 103 (a) as being unpatentable over Konig in view of Holzl, and further in view of Umeya and in view of Bickmore. The Office states that it would have been obvious to one of ordinary skill in the art at the time of the invention was made to have used metal carboxylates in Konig in view of

Holz1 instead of metal amides with the expectation of providing the desired nanoscale powders since Bickmore teach that carboxylates and amides may be used for manufacturing nanoscale powder.

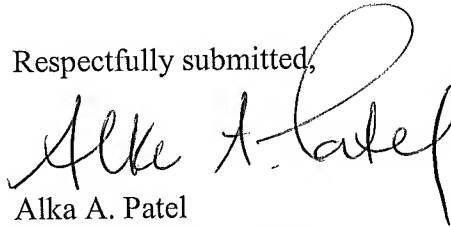
Claims 31-33 depend directly from and add further limitations to independent claim 1 and are allowable over Konig in view of Holz1 and Umeya for at least the same reasons set-forth above with respect to independent claim 1, namely none of Konig, Holz1, or Umeya teach or suggest at least preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor, and therefore any combination of these references still fails to teach preparing a mixture as recited in the claims. Additionally, Bickmore describes a method for producing homogenous nanoparticle powders from mixtures of elements and not carrier particles coated with a metal-containing precursor as presently claimed and therefore also fails to cure the deficiencies of Konig, Holz1 and Umeya. Furthermore Appellant respectfully submits that the Office's rejections again focus on the composition of the particles rather than appreciating the absence of any teaching of the claimed recited steps for manufacturing powder in any of the cited references. Nevertheless this combination of references fails to render independent claim 1 and by association claims 31-33 obvious. Accordingly, for at least these reasons, the rejection of claims 31-33 under 35 U.S.C. § 103(a) should be overturned.

**CONCLUSION**

Appellant respectfully asserts that all of the above cited references fail to teach or fairly suggest each and every element of the pending claims, and that the Office has improperly overextended the teaching of the cited prior art to include specific limitations that cannot be derived from the text of these references. Furthermore, the Office has failed to consider the pending claims and the cited art as a whole as the cited references fail to render obvious preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor. For at least these reasons, Appellant respectfully asserts that the Office's obviousness rejections are moot as the Office has failed to establish a *prima facie* case of obviousness.

Reversal of all of the Examiner's rejections and allowance of claims 1, 4, 6, 11-15, 17, 18, 20, 27, and 31-35 is respectfully requested.

Respectfully submitted,



Alka A. Patel

Registration No. 49,092

Pietragallo Gordon Alfano Bosick & Raspanti, LLP

One Oxford Centre, 38th Floor

301 Grant Street

Pittsburgh, PA 15219

Attorney for Appellant

(412) 263-1845 (phone)  
(412) 261-0915 (facsimile)  
[aap@pietragallo.com](mailto:aap@pietragallo.com)

## **VIII. CLAIMS APPENDIX**

1. A method of manufacturing powder comprising:  
preparing a mixture of one or more metal-containing precursors and carrier particles to create a slurry precursor;  
feeding the slurry precursor to a reaction zone of a high temperature reactor thereby creating a vapor of the slurry precursor;  
adding a reactive fluid to the slurry precursor in the reaction zone thereby creating a stream of vaporized slurry precursor and reactive;  
processing the stream at high temperature;  
cooling the stream to nucleate the slurry precursor thereby creating nucleated nanoscale powders; and  
quenching the stream of nucleated nanoscale powders thereby preventing agglomeration and grain growth;  
wherein the powder manufactured is a nano-dispersed nanopowder of carrier particles and metal-containing precursor particles that are dispersed on and attached to the surface of the carrier particles.
2. (withdrawn) The method of claim 1, wherein the metal-containing precursor is selected from the group comprising an emulsion, fluid, particle-containing liquid slurry, a gas, a solid, a single-phase liquid, a multi-phase liquid, a melt and a fluid mixture.
3. (cancelled)
4. The method of claim 1, wherein the metal-containing precursor comprises multiple metal-containing precursors.
5. (withdrawn) The method of claim 1, wherein the nanoscale powder comprises a metal.
6. The method of claim 1, wherein the reactive fluid comprises oxygen.
7. (withdrawn) The method of claim 1, wherein the reactive fluid comprises carbon.

8. (withdrawn) The method of claim 1, wherein the reactive fluid comprises nitrogen.
9. (withdrawn) The method of claim 1, wherein the reactive fluid comprises boron.
10. (withdrawn) The method of claim 1, wherein the reactive fluid comprises hydrogen.
11. The method of claim 1, wherein feeding the metal-containing precursor to the reaction zone comprises spraying that enhances heat transfer efficiency, mass transfer efficiency, momentum transfer efficiency, and reaction efficiency.
12. The method of claim 1, wherein the reaction zone is surrounded by a concentric zone to reduce non-uniformities in heat, mass or momentum transfer.
13. The method of claim 1, wherein processing is achieved using one or more techniques selected from the group consisting of plasma processes, internal energy, heat of reaction, conduction, convection, radiation, inductive, microwave, electromagnetic, direct electric arc, pulsed electric arc, laser and nuclear.
14. The method of claim 1, wherein processing is carried out by combustion.
15. The method of claim 1, wherein processing is performed at a temperature greater than 1500° C.
16. (cancelled)
17. The method of claim 32, wherein the harvesting is accomplished using one or more techniques from the group consisting of bag filtration, electrostatic separation, membrane filtration, cyclones, impact filtration, centrifugation, hydrocyclones, thermophoresis, magnetic separation, impingement filters, screen filters, fabric filters and scrubbers.
18. The method of claim 1, wherein the quenching is accomplished using adiabatic expansion.
19. (cancelled)
20. The method of claim 1, wherein the process operates near ambient pressure.
21. (withdrawn) The method of claim 1, wherein the process operates at a pressure less than 750 mm Hg absolute.



22. (withdrawn) The method of claim 21, wherein the pressure is achieved using a compressed fluid-based eductor operating on a venturi principle.

23. (withdrawn) A method of producing nanoscale particles in vacuum wherein the vacuum is achieved using a compressed fluid-based eductor operating on a venturi principle.

24. (cancelled)

25. (withdrawn) The method of claim 1, wherein the metal-containing precursor comprises nanoscale powder and coarse carrier particles.

26. (withdrawn) The method of claim 1, wherein the powder manufactured comprises carrier particles comprising a ceramic and attached particles comprising metal.

27. The method of claim 1, wherein the powder manufactured comprises carrier particles comprising a ceramic and attached particles comprising an alloy.

28. (withdrawn) The method of claim 1, wherein the powder manufactured comprises carrier particles comprising a ceramic and attached particles comprising an oxide.

29. (withdrawn) The method of claim 1, wherein the powder manufactured comprises carrier particles comprising a ceramic and attached particles comprising a ceramic.

30. (withdrawn) A powder manufactured using the method of claim 1.

31. The method of claim 1, wherein the one or more metal-containing precursors is a metal carboxylate.

32. The method of claim 1, further comprising harvesting the nucleated nanoscale powders.

33. The method of claim 1, wherein the one or more metal-containing precursors is selected from the group consisting of metal acetates, metal carboxylates, metal nitrates, metal sulfates, and metal hydroxides.

34. The method of claim 1, wherein the carrier particles are selected from particles comprising simple oxides, multi-metal oxides, doped oxides, carbides, nitrides, borides, complex ceramics, and non-stoichiometric ceramics.

35. The method of claim 1, wherein the ratio of the average size of the carrier particles to the average size of the attached particles is greater than or equal to 2.

**IX. EVIDENCE APPENDIX**

None

**X. RELATED PROCEEDINGS APPENDIX**

None